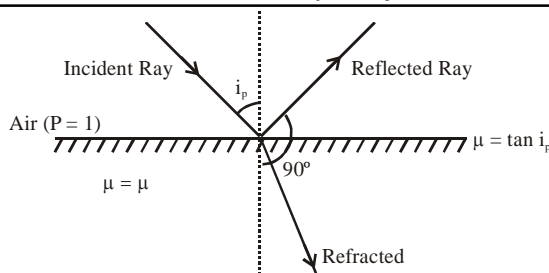


DICTIONARY OF PHYSICS

- **Abbe number**
Reciprocal of the dispersive power of a substance.
- **Absorption Coefficient**
Measure of rate of decrease in intensity of em radiation when it passes through the given substance.
- **Admittance**
Reciprocal of impedance. It refers to the measure of the ability of a circuit to contact an alternating current.
- **Acclinic line**
The line joining the places of zero dip. This line is also known as magnetic equator and goes nearly side by side with geographical equator.
- **Acoustics**
Branch of physics that is concerned with the study of sound and sound waves.
- **Actinometer**
Instrument for measuring the intensity of em radiation.
- **Agonic line**
The line of zero declination.
- **Albedo**
Ratio of the amount of light reflected from a surface to the amount of incident light.
- **Alfa-decay**
A form of radioactive decay where a radioactive nuclei spontaneously emits α -particles (nuclei of ${}^4_2\text{He}$)
- **Alternator**
Any device that is used to generate an alternating current.
- **Altimeter**
An electronic device that indicates altitude above the surface of earth.
- **Amalgam**
An alloy (a material consisting of two or more elements e.g., brass is an alloy of Cu and Zn, steel is an alloy of iron & carbon) one of whose constituents is mercury (Hg).
- **Ammeter**
An instrument used to measure electric current.
- **Ampere-hour**
A practical unit of electric charge equal to the charge flowing in one hour through a conductor passing one ampere. It is equal to 3600 coulombs.
- **Ampere-rule**
A rule that relates the direction of the electric current passing through a conductor and the magnetic field associated with it. The rule states that if the electric current is moving away from an observer, the direction of the lines of force of the magnetic field surrounding the conductor is clockwise and that if the electric current is moving towards an observer, the direction of the lines of force is counter clockwise.
- **Amorphous**
A solid that is not crystalline i.e., one that has no long range in its lattice. Example : Glass.
- **Amplifier**
A device that increase the strength of an electrical signal by drawing energy from a separate source to that of the signal.
- **Anisotropic**
Substance showing different physical properties in different directions.
- **Aperture**
The size of the opening that admit light in an optical instrument. The effective diameter of mirror and lens.

- **Aphelion**
The farthest point in the orbit of planet, comet and artificial satellite around the sun. The earth is at aphelion on about July 3.
- **Apogee**
Maximum distance of a satellite from the earth during its orbit around the earth.
- **Asteroids or minor planets**
Small bodies that revolve around the sun.
- **Astrology**
Branch of science that is concerned with the study of influence of heavenly bodies on human affairs.
- **Astronomical unit AU**
A unit of distance in astrology in the solar system. It is equal to the mean distance of sun from earth ($\sim 1.496 \times 10^{11}\text{m}$)
- **Astronomy**
The study of the universe beyond the earth's atmosphere
- **Atomic clock**
A highly accurate clock. It is regulated by the resonance frequency of atoms or molecule of certain substance such as cesium.
- **Atomic mass unit (a.m.u.)**
A unit of mass used to express "relative atomic masses. It is $1/12$ of the mass of an atom of the isotope carbon-12 and is equal to $1.66033 \times 10^{-27}\text{ kg}$.
- **Atomiser**
A device that is used for reducing liquid to a fine spray.
- **Aurora**
An intermittent electrical discharge that takes place in rarefied upper atmosphere. Charge particles in the solar wind (or cosmic - rays) becomes trapped in the earth's magnetic field and move in helical paths along the lines of force between the two magnetic poles. The intensity of the aurora is greatest in polar regions although it is seen in temperate zones.
- **Autotransformer**
A transformer having a single winding instead of two or more independent windings.
- **Avogadro constant**
Symbol N_A . The number of atoms or molecules in one mole of substance, It has value $6.0221367 (36) \times 10^{23}$. Formerly it was called Avogadro's number.
- **Avogadro's Law**
Equal volumes of all gases contain equal numbers of molecule at the same pressure and temperature. The law, often called Avogadro's hypothesis, is true only for ideal gases. It was first proposed in 1811 by Amadeo Avogadro.
- **Ballistic galvanometer**
A device used to measure the total amount of charge that passes through a circuit due to a momentary current.
- **Band spectrum**
In such a spectrum there appears a number of bands of emitted or absorbed radiations. This type of spectrum are characteristic of molecules.
- **Band width**
It refers to the width of the range of frequencies.

- **Barn**
A unit of area & generally used for measuring nuclear cross section ($1 \text{ barn} = 10^{-28} \text{ m}^2$)
- **Barometer**
A device used to measure atmospheric pressure.
- **Becquerel**
SI unit of radio-activity ($1 \text{ Bq} = 1 \text{ disintegration/sec.} = \frac{1}{3.7 \times 10^{10}} \text{ curie}$)
- **Bel**
Ten decibels (10 dB)
- **β -rays**
A stream of β -particles (fast moving electrons)
- **Betatron**
A device used to accelerate the electrons.
- **Bevatron**
An accelerator used to accelerate protons and other particles to very high energies.
- **Binary star**
A system of two stars which revolve around a common centre of gravity.
- **Binding energy**
The energy required to separate the nucleons (protons & neutrons) of a nucleus from each other. The binding energy per nucleon is least for very light and very heavy nuclei and nearly constant ($\sim 8 \text{ MeV/nucleon}$) for medium nuclei.
- **Bipolar transistor**
A transistor that uses two type of charge carriers (electrons & holes) for its operation.
- **Black body**
A perfectly black body is one that absorbs completely all the radiations falling on it. Its absorptance and emissivity are both equal to 1.
- **Black hole (collapsar)**
An astronomical body having so high gravitational field in which neither matter particles nor photons can escape (they are captured permanently from the outside)
- **Bolometer**
A device used to measure amount of radiation by means of changes in the resistance of an electric conductor caused due to changes in its temperature.
- **Boson**
An elementary particle with integral spin. ex. : photon.
- **Bragg's law**
When an X-ray beam of wavelength λ is incident on a crystal of interplanar spacing d at grazing angle [complement of the angle of incident] then the direction of diffraction maxima are given by $2d \sin \theta = n\lambda$, which is known as Bragg's law.
- **Brewster's law**
The extent of the polarization of light reflected from a transparent surface is a maximum when the reflected ray is at right angle to the refracted ray. The angle of incidence (and reflection) at which this maximum polarization occurs is called the Brewster angle or polarizing angle.



■ **British Thermal Unit (BTU)**

Quantity of heat required to raise the temperature of 1 pound of water through 1°C.

■ **Bulk modulus (K)**

$$K = \frac{\text{stress}}{\text{volume strain}} = \frac{\Delta P}{(\Delta V / V)} = \frac{1}{\text{compressibility}}$$

■ **Calibration**

It is the process of determining the absolute values corresponding to the graduations on an arbitrary or inaccurate scale on an instrument.

■ **Calipers**

An instrument used for measuring internal and external diameters. It is a graduated rule with one fixed and one sliding jaw.

■ **Caloric theory**

It regards heat as a weightless fluid. It has now been abandoned.

■ **Calories**

It is equal to the amount of heat required to raise the temperature of 1 gram of water through 1°C. 1 cal = 4.2 Joules.

■ **Calorific value**

The quantity of heat liberated on complete combustion of unit mass of a fuel. The determination is done in a bomb calorimeter and the value is generally expressed in J kg⁻¹.

■ **Calorimeter**

An instrument used for measuring quantity of heat. It consists of an open cylindrical container of copper or some other substance of known heat capacity.

■ **Calorimetry**

It is the study of the measurement of quantities of heat.

■ **Canal rays, Anod rays, Positive rays :**

Positively charged rays produced during the discharge of electricity in gases.

■ **Candela**

It is a S.I. unit of luminous intensity. It is equal to 1/60 of the luminous intensity of a square centimeter of a black body heated to the temperature of solidification of platinum (1773.5°C) under a pressure of 101325 N/m² in the perpendicular direction.

■ **Cannon**

A mounted gun for firing heavy projectiles.

■ **Capacitor**

It is a device which is used for storing electric charge. It consists of two metal plates separated by an insulator. It is also known as **Condenser**.

■ **Capacitive reactance**

It is the opposition offered by capacitance to the flow of alternating current.

$$X_c = \frac{1}{2\pi fC} \quad \text{Where} \quad X_c = \text{capacitive reactance in ohms}$$

f = frequency in cycles/sec C = capacitance in farads

■ **Capillary action or Capillarity**

The phenomenon of rise or fall of a liquid in capillary tube when it is dipped in the liquid. Due to this the portion of the surface of the liquid coming in contact with a solid is elevated or depressed.

■ **Carat**

- A measure of fineness (purity) of gold. Pure gold is described as 24-carat gold. 14-carat gold contains 14 parts in 24 of gold, the remainder usually being copper.
- A unit of mass equal to 0.200 gram, used to measure the masses of diamond and other gemstones.

■ **Capillary tube**

A tube having a very small internal diameter.

■ **Carbon dating**

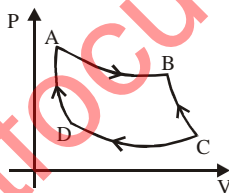
It is a method used to determine the age of materials that contain matter of living organism. It consists of determining the ratio of $^{12}_6\text{C}$ to $^{14}_6\text{C}$.

■ **Carbonize**

Means to enrich with carbon.

■ **Carnot cycle**

It is a reversible cycle and consists of two isothermal ($A \rightarrow B$ and $C \rightarrow D$) and two adiabatic ($B \rightarrow C$, $D \rightarrow A$) changes.



■ **Carnot theorem**

- The efficiency of a reversible heat engine (Carnot engine) working between any two temperature is greater than the efficiency of any heat engine working between the same two temperature.
- The efficiency of a reversible heat engine depends only on the temperature of the source and the sink and is independent of the working substance.

■ **Cathode**

The electrode that emits electrons or gives off negative ions and towards which positive ions move or collect in a voltaic cell, electron or X-ray tube etc.

■ **Cathode ray**

The rays emitted in a discharge tube when the pressure falls to about 10^{-4} mm of mercury.

■ **Cathode ray oscilloscope or CRO**

An instrument based on the cathode ray tube that provides a visual image of electrical signals.

■ **Cathode ray tube**

A vacuum tube generating a focussed beam of electrons that can be deflected by electric and magnetic fields.

■ **Cation**

A positively charged ion i.e., Na^+ , Ba^{2+} etc.

■ **Cauchy dispersion formula**

A formula for the dispersion of light of the form : $n = A + \left(\frac{B}{\lambda^2} \right) + \left(\frac{C}{\lambda^4} \right)$,

where n is the refractive index, λ the wavelength and A , B and C are constants. Sometimes only the first two terms are necessary.

■ **Centre of buoyancy**

It is the point through which the resultant of the buoyancy forces on a submerged body act, it coincides with the centre of gravity of the displaced fluid.

■ **Centre of gravity**

It is the point through which the weight of the body acts. It is the point where the whole of the weight of the body may be supposed to be concentrated.

■ **Centre of mass**

For any system it is the point at which the whole of the mass of the body (or system) may be considered to be acting for determining the effect of some external force.

■ **Cerenkov radiation**

Electromagnetic radiation, usually bluish light, emitted by a beam of high-energy charged particles passing through a transparent medium at a speed greater than the speed of light in that medium. It was discovered in 1934 by the Russian physicist Pavel Cerenkov (1904). The effect is similar to that of a sonic boom when an object moves faster than the speed of sound; in this case the radiation is a shock wave set up in the electromagnetic field. Cerenkov radiation is used in the Cerenkov counter.

■ **Chip**

A very small semi-conductor having a component (transistor, resistor, etc.) or an integrated circuit.

■ **Choke**

It is a coil of high inductance and low resistance which is used to block or reduce the high frequency components of an electrical signal.

■ **Chromatic aberration**

It is a defect of the image formed by a lens (but not a mirror), in which different colours come to focus at different points. It can be corrected by using a suitable combination of lenses.

■ **Circuit breaker**

It is a device that is used for interrupting an electric circuit when the current becomes excessive.

■ **Classical physics**

Refers to the physics that has been developed before the introduction of quantum theory.

■ **Classical mechanics**

The branch of mechanics based on Newton's laws of motion. It is applicable to those systems which are so large that in their case Planck's constant can be neglected.

■ **Closed end organ pipe**

In these cases one end of the pipe is closed. In the first harmonic is given by $\lambda/4$. In such cases only the odd harmonics are produced and even harmonics are missing. Fundamental frequency = $v/4\ell$.

■ **Coefficient of expansion**

It is the increase in unit length, area or volume per degree rise in temperature.

■ **Coefficient of friction** $\mu = \frac{f}{R}$

Where f = Limiting friction. R = Normal reaction

Also $\mu = \tan \theta$; where θ = angle of friction.

■ **Coefficient of restitution**

The ratio of the relative velocity of two bodies after direct impact to that before impact.

■ **Coefficient of mutual inductance**

- It is numerically equal to the magnetic flux linked with one circuit when unit current flows through it. The effective flux N_s linked with secondary circuit is given by $N_s = M i$.
- It is numerically equal to the e.m.f. induced in one circuit when the rate of change of current in the other is unit.

The e.m.f. induced in a secondary coil, when the rate of change of current with time in primary coil is $\frac{di}{dt}$ is given

by, $e_s = M \frac{di}{dt}$.

■ **Coefficient of thermal conductivity (K)**

It is the amount of heat flowing in one second across the 1m^2 area of a 1 metre rod, maintained at a temperature difference of 1°C .

■ **Coefficient of viscosity**

It is the tangential force required to maintain a unit velocity gradient between two layers of unit area. Its units are Nsm^{-2} or poiseulle or decapoise.

■ **Coefficient of self-induction**

- It is numerically equal to the magnetic flux linked with the coil when the unit current flows through it. The effective flux N is given by $N = Li$ where i = current flowing through the circuit.
- It is numerically equal to the e.m.f. induced in the circuit when the rate of change of current is unity.
- It is numerically equal to twice the work done against the induced emf in establishing unit current in the coil.

■ **Coercive force**

It is the magnetic intensity required to reduce the magnetic induction in a previously magnetised material to zero.

■ **Complementary colours**

A pair of colours which, when combined give the effect of white light. A large number of such are possible.

■ **Compound microscope**

A microscope consisting of an objective lens with a short focal length and an eye piece of a longer focal length, mounted in the same tube.

■ **Compound pendulum**

In such a pendulum the moment of the restoring force is $\tau = mgd \sin \theta$. If θ (in radians) is sufficiently small,

then $\tau = -mgd \theta$. Time period of such a pendulum is $T = 2\pi \sqrt{\frac{I}{Mgd}}$

■ **Compton effect**

The phenomenon according to which the wavelength of radiation scattered by a particle is greater than that of the original radiation is called compton effect.

■ **Condensation**

A change of state from vapour to liquid. In this state the vapour pressure becomes equal to the saturated vapour pressure (SVP) of liquid state.

■ **Conductance**

It is the reciprocal of resistance. It is the ability of a conductor to transmit current. Its unit is mho, ohm^{-1} or siemens.

■ **Conduction**

A method of heat transfer. In this mode of heat transfer the particles do not move.

■ **Conservation of angular momentum**

In the absence of any external torque the total angular momentum of a system remains unchanged.

■ **Conservation of charge**

For an isolated system the total charge remains constant.

■ **Conservation of linear momentum**

In the absence of any external force the total linear momentum of the system remains constant.

■ **Conservation of mass energy**

The total energy of a closed system, viz., rest mass energy + kinetic energy + potential energy remains constant. This principle treats the rest mass as energy. The rest mass energy of a particle having rest mass m_0 is m_0c^2 .

■ **Conservative field**

It is that vector field for which the line integral depends on the end points of the path only and is independent of the path. A conservative field can always be expressed as the gradient of a scalar field.

■ **Constantan**

An alloy containing about 50% copper and 50% nickel having comparatively high resistance and low temperature coefficient of resistance.

■ **Convection**

A mode of heat transfer. In this mode the movement of particles occur.

■ **Corona discharge**

A discharge, generally luminous, at the surface of a conductor or between two conductors of the same transmission line.

■ **Corpuscular theory of light**

It assumes that light travels as particles or corpuscles. It is useful to explain reflection, refraction etc. It cannot explain diffraction, polarisation etc.

■ **Cosmic rays**

These are high energy radiations. These consist of protons and some α -particles, electrons and other atomic nuclei and γ -rays reaching the earth from space.

■ **Cosmology**

The branch of astronomy that deals with the evolution, general structure and nature of the universe as a whole.

■ **Critical mass**

It is the minimum mass of a fissile material that will sustain a chain reaction.

■ **Critical pressure**

It is the saturated vapour pressure of a liquid at its critical temperature.

■ **Critical temperature**

It is the temperature above which a gas can not be liquefied by increasing the pressure alone.

■ **Critical velocity**

The velocity of fluid flow at which the motion changes from laminar to turbulent flow.

■ **Critical volume**

The volume of a certain mass of substance measured at critical pressure and temperature.

■ **Cryogenics**

The study of the production and effects of very low temperature. A cryogen is a refrigerant used for obtaining very low temperature.

■ **Cryometer**

A thermometer designed to measure low temperature.

■ **Curie**

A unit of measure the activity of a radioactive substance (see radio activity). It is the quantity of radon in radioactive equilibrium with 1 g of radium. Also defined as that quantity of a radioactive isotope which decays at the rate of 3.7×10^{10} disintegrations per second. Named after Madame Curie (1867-1987).

■ **Curie's law**

The value of (χ) susceptibility of a paramagnetic substance is inversely proportional to its absolute temperature

$$\chi \propto \frac{1}{T}$$

■ **Cyclotron**

An accelerator in which particles move in a spiral path under the influence of a alternating voltage and magnetic field.

■ **Daughter nucleus**

Refers to the nucleus that results from the radioactive decay of another nucleus known as parent nucleus.

■ **Dead beat galvanometer**

A galvanometer which is damped so that its oscillations die away very quickly. In such galvanometer its resistance is less than its critical damping resistance.

■ **De broglie wavelength**

The wavelength of the wave associated with a moving particle. The wavelength (λ) is given by $\lambda = h/mv$, where h is the Planck constant, m is the mass of the particle and v its velocity. The de Broglie wave was first suggested by the French physics Louis de Broglie (1892) in 1924 on the grounds that electromagnetic waves can be treated as particles and one could therefore expect particles to behave in some circumstances like waves. The subsequent observation of electron diffraction substantiated this argument and the de Broglie wave become the basis of wave mechanics.

■ **Debye length**

It is the maximum distance at which coulombs fields of charged particles in a plasma may be expected to interact.

■ **Deca**

Symbol : The prefix meaning 10, eg., 1 decameter = 10 metres.

■ **Deci**

A prefix measuring 10^{-1}

■ **Decibal dB**

A unit for expressing the intensity of a sound wave. It is measured on a logarithmic scale.

■ **Declination**

The horizontal angle between the directions of true north and magnetic north.

■ **Delta-ray**

A low energy electron emitted by a substance after bombardment by high energy particles (eg., α -particle)

■ **Degrees of freedom**

The number of independent co-ordinates needed to define the state of system.

■ **Demagnetisation**

To remove the ferromagnetic properties of a body. It can be done by disordering the domain structure.

■ **Deuteron**

Nucleus of deuterium atom. It consist of one proton and one neutron.

■ **Dew**

Water droplets formed due to condensation of water vapour in the air when the temperature of air drops so that the quantity of vapour present at that temperature reaches saturation.

■ **Dew point**

It is the temperature to which air must be cooled for dew to form. At this temperature air becomes saturated with water vapours present in it.

■ **Dew point hygrometer**

It is an instrument used for determination of relative humidity.

■ **Diamagnetic substance**

Refer to those substance that have a negative value of susceptibility. They are repelled when placed in a

magnetic field.

■ **Diamagnetism**

Diamagnetic substance when placed in a magnetic field get feebly magnetised in direction opposite to that of magnetising field. This property of diamagnetic substance is known as diamagnetism.

■ **Dielectric**

Refers to an insulator, a non-conducting substance.

■ **Dielectric constant (Relative permittivity)**

$$\text{Dielectric constant} = \frac{\text{Absolute permittivity of the medium}}{\text{Absolute permittivity of vacuum}} = \frac{\epsilon}{\epsilon_0} = \epsilon_r = K$$

■ **Dielectric strength**

Refers to the maximum electric field that a dielectric is capable of withstanding without a break down.

■ **Diffraction**

It refers to the bending of light round an obstacle.

■ **Diffraction grating**

A glass plate with a very large number of closely spaced parallel line (usually more than 5000 to the inch) scrapped across it. These are used for diffracting light to produce optical spectra.

■ **Diffusion length**

It is the average distance that is travelled by minority carriers between generation and recombination in a semiconductor.

■ **Diopetre**

It is a unit of measurement of the refractive power of a lens. It is equal to the reciprocal of the focal length of a lens expressed in metres.

■ **Dip Inclination (ϕ)**

The dip at a place is the angle which the earth's field makes with earth's surface at a place.

■ **Dip circle**

It is an instrument that is used to measure the angle of dip at a place. It consists of a magnetic needle mounted in such a way that it can rotate in a vertical plane. The angle is measured on a circular scale.

■ **Dipole**

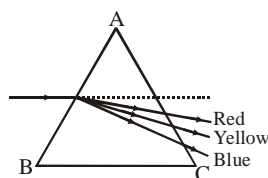
Refers to two equal and opposite electric charges (or magnetic poles) separated by a distance.

■ **Dipole moment**

It is equal to the product of pole strength and the length of magnetic electric dipole.

■ **Dispersion**

The separation of white light into its constituent colours by refraction or other means is called dispersion of light.



■ **Dispersive power (ω)**

Dispersive power of the material of the prism is given by $w = \frac{\mu_b - \mu_r}{\mu - 1}$ for blue & red rays. Where μ_b and μ_r are the refractive index of blue and red rays respectively and μ is the refractive index for yellow rays.

■ **Doping**

It refers to the process of adding some amount of impurities in semi-conductors to achieve a desired conductivity.

■ **Double refraction**

When a beam of light is incident on certain materials, it breaks it into two plane polarised beams with their

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plane of polarisation perpendicular to each other. The two beams have different velocities in the medium. This phenomenon is called double refraction.

■ **Dry ice**

Solid carbon dioxide.

■ **Ductility**

Property by which metals are capable of being, drawn in wires.

■ **Dulong and Petit's law**

It states, "The product of atomic weight and specific heat of a solid element is approximately 6.4."

■ **Dynamo**

An electric generator. It produces direct current by converting mechanical energy into electrical energy. It consists of a strong electromagnet between the poles of which an armature is rotated, consisting of a number of coils suitably wound. It is based on the principle of electromagnetic induction.

■ **Earthing**

Refers to connecting an electrical conductor to earth which is assumed to have zero electric potential.

■ **Earth's atmosphere**

The gas that surrounds the earth. The composition of dry air at sea level is: nitrogen 78.08%, oxygen 20.95%, argon 0.93%, carbon dioxide 0.03%, neon 0.0018%, helium 0.005%, krypton 0.0001% and xenon 0.00001%. In addition to water vapour, air in some localities contains sulphur compounds, hydrogen peroxide, hydrocarbons and dust particles.

■ **Eclipse**

To prevent light from a source reaching an object. It refers to shadowing one heavenly body by another. In **solar eclipse** shadow of the moon falls on the earth when the sun, moon and the earth are in line. In **lunar eclipse** shadow of the earth falls on the moon, when the earth is in between the sun and the moon.

■ **Efficiency**

The ratio of the useful energy output to the total energy input in any energy transfer. It is after given as percentage and has no units.

■ **Effusion**

The flow of gas through a small aperture.

■ **Einstein's equation**

Refers to the equation, $KE_{\max} = h\nu - \phi_0$ for the kinetic energy of electrons which are emitted in photoelectric effect, ν the frequency of incident radiation and ϕ_0 the work function of the photomaterial upon which the radiation is incident.

■ **Einstein's law**

Mathematically it can be expressed as $E = mc^2$.

■ **Electric motor**

A device that convert electrical energy into mechanical energy.

■ **Electrocardiograph (ECG)**

It is a sensitive instrument that records the voltage and current waveforms associated with the action of the heart. The trace obtained is called electrocardiogram.

■ **Electroencephalograph (EEG)**

A sensitive instrument that records the voltage waveforms associated with the brain. The trace obtained is called electroencephalogram.

■ **Electrogen**

A molecule that emits electrons on being illuminated.

■ **Electron microscope**

It is a type of microscope in which an electron beam is used to study very minute particles.

■ **Electromagnet**

A magnet formed by winding a coil of wire around a piece of soft iron. It behaves as a magnet as long as the current passes through the coil.

■ **Electrometer**

An instrument that is used for determining the potential difference between two charged bodies by measuring the electrostatic force between them.

■ **Electroscope**

A device consisting of two pieces of gold leaf enclosed in a glass walled chamber. It is used for detecting the presence of electric charge or for determining the sign of electric charge on a body.

■ **Electrostatic shield**

A conducting substance which protects a given apparatus against electric fields. It consists of a hollow conductor and completely surrounds the apparatus to be shielded.

■ **Emissivity**

The ability of a surface to emit radiant energy compared to that of a black body at the same temperature and with the same area.

■ **Emissive power**

The total energy emitted from unit area from the surface of a body per second.

■ **Enthalpy (H)**

$$H = E + PV, \quad H = U + PV$$

Where U = internal energy of the system.

P = Pressure and V = Volume

■ **Entropy (S)**

A measure of the degree of disorder of a system. An increase in entropy is accompanied by a decrease in energy availability. When a system undergoes a reversible change then $\Delta S = \frac{\Delta Q}{T}$. The importance of entropy in that in any thermodynamic process that proceeds from one equilibrium state to another, the entropy of system + environment either remains unchanged or increases.

■ **Evaporation**

The change of state from liquid to gas which can occur at any temperature upto the boiling point. If a liquid is left in an open container for long enough it will all evaporate.

■ **Extrinsic semi-conductor**

A semi-conductor in which the carrier concentration is dependent upon extent of impurities.

■ **Expansion of the universe**

The hypothesis, based on the evidence of the * redshift, that the distance between the galaxies is continuously increasing. The original theory, which was proposed in 1929 by Edwin Hubble (1889-1953), assumes that the galaxies are flying apart like fragments from a bomb as a consequence of the big bang with which the universe originated.

■ **Fall out (or radioactive fall out)**

Radioactive particles deposited from the atmosphere either from a nuclear explosion or from a nuclear accident. Local fall-out within 250 km of an explosion, falls within a few hours of the explosion. Tropospheric fall-out consists of fine particles deposited all around the earth in the approximate latitude of the explosion within about one week, Stratospheric fall-out may fall anywhere on earth over a period of years.

■ **Faraday's law of electrolysis**

First Law $W = Zit$

Where

$$W = \text{Wt. of ions liberated from an electrolyte.}$$

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Z	=	Electrochemical equivalent (E.C.E)
t	=	Time in seconds for which current is passed
i	=	Current in amperes

■ **Faraday's Law of electromagnetic induction**

- Whenever the number of lines of force linked (Flux) with any closed circuit changes and induced current flows through the circuit which lasts only so long as the change lasts.
- The magnitude of induced emf produced in a coil is directly proportional to the rate of change of lines of force threading the coil $e \propto \frac{d\phi}{dt}$; where ϕ = flux (or number of lines of force threading the circuit)

■ **Fahrenheit scale of temperature**

On this scale the melting point of ice is 32°F and the boiling point of water is 212°F. The distance between these two points is divided in 180 equal parts, each part 1°F, It is related to centigrade scale as $\frac{C}{100} = \frac{F-32}{180}$.

■ **K-capture**

Refers to an absorption of electron from the innermost (K-shell) shell of an atom into its nucleus.

■ **Karat (US)**

It is a unit used to specify the purity of gold. A pure gold is 24 Karat gold.

■ **Kepler's law**

- The planets move around the sun in elliptical orbits with the sun at one focus of the ellipse.
- The radius vector from the planet to the sun sweeps out equal areas in equal intervals of time.
- The ratio of $\frac{T^2}{a^3}$ = constant, where T is the period of the planet's orbit around the sun and a is the semi-major axes of the ellipse.

■ **Kilo watt-hour (kWh)**

It is a practical unit of work (or energy). It is equal to the energy supplied by one kilowatt of power in one hour.

$$1 \text{ kWh} = 3.6 \times 10^6 \text{ joule}$$

■ **Kinetic friction**

Refers to the friction that acts on body when it is moving over a second body.

■ **Kirchhoff's law (Electrostatics)**

- **First law :** It is also known as Junction rule. It states, "The algebraic sum of the currents at a given junction in a circuit is zero". $\sum i = 0$. Thus there could be no accumulation of current at any point in the circuit.
- **Second law :** It is also known as loop rule "In a closed circuit, the algebraic sum of the products of the current and the resistances of each part of the circuit is equal to total emf in the circuit. " $\sum ir = \sum E$ "

■ **Kirchhoff's law (Heat)**

For a given temperature and wavelength the ratio of emissive power of a substance to its absorptive power is the same for all substances and is equal to the emissive power of a perfectly black body at that temperature.

■ **Kundt's tube**

It is a glass tube whose one end is fitted with a light adjustable piston and its another end is closed by a cap through which passes a metal rod clamped at its centre. A small quantity of lycopodium powder is spread uniformly through out the tube. The free end of the rod is rubbed to and fro along its length. Stationary waves are produced in the air column in the tube. By measuring the wavelength it is possible to calculate the velocity of sound in air in terms of the Young's modulus, length and density of the rod and the wavelength of stationary waves.

■ **Lactometer**

It is an instrument that is used to find out the specific gravity of milk.

■ **Lambert's law**

The illuminance of a surface that is illuminated by a point source of light normally is proportional to $1/r^2$ where r is the distance between the source and the surface. If the incident rays make an angle θ with the normal to the ray, then the illuminance is proportional to $\cos \theta$.

■ **Laminar flow**

Refers to the flow of a fluid along a stream lined surface without any turbulence.

■ **Laminated iron**

A piece of iron consisting of thin sheets of iron. Such a piece of iron is used for cores of transformers. It helps to minimize losses due to eddy currents.

■ **Laser**

It stands for light amplification by stimulated emission of radiation, A highly powerful, coherent, monochromatic light source. Such light is of great use in medicine, telecommunication industry and holography.

■ **Latent heat**

Hidden heat. It is the energy involved in changes of state. In each case, the temperature stays constant while the change of state takes place. A similar situation exists in the changes from liquid to gas and gas to liquid. The quantity of energy transformed from and to the particles during changes of state depends on the nature of the substance and its state.

■ **Lateral inversion**

Refers to the type of inversion produced in the image formed by a plane mirror. The left hand side appears as right hand side and vice versa.

■ **Latitude**

Refers to the angular distance north or south from the equator of a point on the earth's surface, measured on the meridian of the point.

■ **Laws of dynamic friction**

- Dynamic friction is proportional to the normal reaction. It is less than static friction.
- It does not depend on the velocity if the velocity is neither too large nor too small.

■ **Laws of limiting friction**

- The force of limiting friction is directly proportional to normal reaction for the same two surface in contact and it takes place in a direction which is opposite to the direction of the force of the pull. Limiting friction is maximum static friction, it is less than static friction. $F \propto R$ (when the body just begins to move $F = \mu R$) Where μ is coefficient of friction.
- Limiting friction is independent of the size and shape of the bodies in contact as long as the normal reaction remains the same.

■ **Law of gravitation**

According to it, all bodies and particles in universe exert gravitational force on one another. The force of gravitation between any two bodies is directly proportional to the product of their masses and inversely proportional to the distance between them.

■ **Laws of intermediate temperature**

The emf of a thermocouple between any two temperatures is equal to the sum of the emf of any number of successive steps in which the given range of temperature is divided. Thus if $E_{t_1}^{t_n}$ is the thermo e.m.f. between

two temperature t_1 & t_n , $E_{t_1}^{t_n} = E_{t_1}^{t_2} + E_{t_2}^{t_3} + E_{t_3}^{t_4} + E_{t_4}^{t_n}$

Where the given temperature range is divided between the steps $t_1, t_2, t_3, \dots, t_n$.

■ **Light Emitting Diode (LED)**

This is a p – n junction diode and is usually made from gallium arsenide or indium phosphide. Energy is released within the LED and this is given off as light. The junction is made near to the surface so that the emitting light can be seen. No light is emitted with a reverse bias. LED are generally coloured red, yellow or green. They are widely used in a variety of electronic devices.

■ **Light year**

It is a unit used to measure the distance between the earth and stars.

1 light year = $365 \times 86400 \times 3 \times 10^8 \text{m} = 9.46 \times 10^{15} \text{m}$

■ **Liquid crystal**

A substance that flows like a liquid but has some order in its arrangement of molecules. Nematic crystals have long molecules all aligned in the same direction, but otherwise randomly arranged. Cholesteric and smectic liquid, crystals also have aligned molecules, which are arranged in distinct layers. In cholesteric crystals the axes of the molecules are parallel to the plane of the layers; in smectic crystals they are perpendicular.

■ **Liquid - Crystal Display (LCD)**

A digital display unit used in watches, calculators etc. It provides a source of clearly displayed digits for a very low power consumption. In the display unit a thin film of liquid crystal is sandwiched between two transparent electrodes (glass with a thin metal or oxide coating). In the commonly used field-effect display, twisted nematic crystals are used. The nematic liquid crystal cell is placed between two crossed polarizers. Polarized light entering the cell follows the twist of the nematic liquid crystal, is rotated through 90° , and can therefore pass through the second polarizer. When an electric field is applied, the molecular alignment in the liquid crystal is altered the polarization of the entering light is unchanged and no light is therefore transmitted. In these circumstances, a mirror placed behind the second polarizer will cause the display to appear black. One of the electrodes, shaped in the form of a digit, will then provide a black digit when the voltage is applied.

■ **Lissajou's figures**

The loci of the resultant displacement of a point subject to two or more simple harmonic motions simultaneously. When the two periodic motions are of the same frequency and are at right angles to each other. The resulting figure varies from a straight line to an ellipse depending on the phase difference between the two motion.

■ **Longitude**

It is the angular distance east or west on earth's surface. It is measured by the angle contained between the meridian of a particular place and some prime meridian.

■ **Lumen**

A unit of luminous flux. One lumen is the luminous flux emitted in a unit solid angle by a point source of one-candle intensity.

■ **Lux**

It is S.I. unit of illuminance. $1 \text{ lux} = 1 \text{ lumen/square meter}$.

■ **Mach number**

It is number that indicates the ratio of the speed of an object to the speed of sound in the medium through which the object is moving.

■ **Magic numbers**

Atomic nuclei with 2, 8, 20, 28, 50, 82, 126 neutrons or protons are quite stable. These numbers are known as magic numbers.

■ **Magnetic axis**

It is the line joining the two poles of a magnet inside its body.

■ **Magnetic elements**

These are the magnetic declination, magnetic dip and the horizontal component of Earth's magnetic field which completely define the Earth's magnetic field at any point on the Earth's surface.

■ **Magnetic equator**

A line perpendicular to magnetic axis and passing through the middle point of the magnet is called equatorial line or magnetic equator.

■ **Magnetic meridian**

It is that vertical plane which passes through the magnetic axis of a freely suspended magnet.

■ **Magnetic storm**

A temporary disturbance of the earth's magnetic field induced by radiation and streams of charged particles from the sun.

■ **Magnetization (M)**

The magnetic moment per unit volume of a magnetised substance.

$$B = \mu_0(H + M) \text{ or } M = \frac{B}{\mu_0} - H$$

Where H is the magnetic field strength, B is the magnetic flux and μ_0 is constant.

■ **Malus law**

It states that the intensity of light transmitted through an analyser is proportional to $\cos^2\theta$ where θ is the angle between the transmission planes of the polariser and the analyser.

■ **Manganin**

A copper alloy containing 13-18% of manganese and 1-4% of nickel. It has a high electrical resistance, which is relatively insensitive to temperature changes. It is therefore suitable for use as a resistance wire.

■ **Maser**

It is a device that is used for amplifying electrical impulses by stimulated emission of radiation.

■ **Mass defect (ΔM)**

It is the difference between the actual nuclear mass and the sum of the masses of its constituents nucleons.

■ **Mass-Energy equation**

$$E = mc^2$$

■ **Maxwell Mx.**

It is unit of magnetic flux on C.G.S. system.

$$1 \text{ Mx} = 10^{-8} \text{ Weber}$$

One maxwell is equal to magnetic flux through one square centimeter normal to a magnetic field of one gauss.

■ **Maxwell's formula**

A formula that connect the relative permittivity ϵ_r of a medium and its refractive index n. If the medium is not ferromagnetic the formula is $\epsilon_r = n^2$.

■ **Mayer's relationship :** $C_p - C_v = R$ Where

C_p = Molar specific heat of gas at constant pressure.

C_v = Molar specific heat of gas at constant volume.

R = Gas constant = $8.314 \text{ Jk}^{-1} \text{ mol}^{-1}$.

■ **Mechanical advantage**

It is the ratio of output force to the input force applied to any mechanism.

$$P \times AF = W \times BF \quad \frac{W}{P} = \frac{AF}{BF} = \frac{\text{Power arm}}{\text{Weight arm}}$$

■ **Meissner effect**

The falling off of the magnetic flux within a superconducting metal when it is cooled to a temperature below the critical temperature in a magnetic field. It was discovered by Walther Meissner in 1933 when he observed that the earth's magnetic field was expelled from the interior of tin crystals below 3.72 K, indicating that as "superconductivity appeared the material became perfectly diamagnetic".

■ **Melde's experiment**

It is an experiment carried out for verification of transverse vibrations of strings.

■ **Melting point**

The fixed temperature at which a solid changes into the liquid state. The melting point of ice is 0°C . Melting point of a solid depends upon pressure. It is also called fusion temperature of the liquid.

■ **Michelson-Morley experiment**

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An experiment conducted by Michelson-Morley in 1881 to show that the velocity of light is not influenced by motion of medium through which it passes.

■ **Micro**

A prefix denoting 10^{-6}

■ **Micron (μ)**

A unit of length $1 \mu = 10^{-6}\text{m}$.

■ **Micrometer**

Refers to any device used for measuring minute distances, angles etc.

■ **Microphone**

An instrument that can transform the air pressure waves of sound into electrical signals and vice-versa. It is used for recording or transmitting sound.

■ **Mirage**

An optical phenomenon that occurs as a result of the bending of light rays through layers of air having very large temperature gradients. An inferior mirage occurs when the ground surface is strongly heated and the air near the ground is much warmer than the air above. Light rays from the sky are strongly refracted upwards near the surface giving the appearance of a pool of water. A superior mirage occurs if the air close to the ground surface is much colder than the air above. Light is bent downwards from the object towards the viewer so that it appears to be elevated or floating in the air.

■ **Mirror equation**

$$\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$$

u = distance of object
 v = distance of image
 f = focal length of mirror

■ **M.K.S. System**

System of units having the fundamental units metre, kilogram and second for the length, mass and time respectively.

■ **Mole**

SI unit of quantity of substance. Amount of a substance that contains as many atoms (molecules, ions etc.) as there are atoms in 0.012 kg. of carbon-12.

■ **Monochromatic**

Having only one colour.

■ **Moseley's law**

According to it the frequencies in the X-ray spectrum of elements, corresponding to similar transitions are proportional to the square of the atomic number of elements.

■ **Multimeter**

An instrument that can be used for measuring various electrical quantities such as resistance, voltage etc.

■ **Mutual inductance**

It refers to the phenomenon by which a current is induced in a coil circuit when current in a neighbouring coil circuit is changed. Direction of current in the secondary coil is opposite to battery current in primary coil (Lenz's law)

■ **Myopia**

A defect of vision. Any one suffering with this defect fails to see distant objects clearly. The image of distance object is formed in front of retina and not on retina. It can be corrected by use of concave lens.

■ **Natural gas**

It is a mixture hydrocarbons and is found in deposit under the earth's surface. It contains upto 90% Methane. It is used as a fuel both in industry and home.

■ **Nautical mile**

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It is unit of distance used for navigation. 1 nautical mile = 6082.66 feet.

■ **Negative crystal**

Refers to that crystal in which the velocity of extra ordinary ray is more than the velocity of ordinary ray e.g., calcite.

■ **Negative resistance**

It is characteristic of certain electronic devices in which the current increases with decrease in voltage.

■ **Neel temperature**

The temperature upto which the susceptibility of antiferromagnetic substances increase with increase in temperature and above which the substance becomes paramagnetic.

■ **Nernst heat theorem**

It is also called the third law of thermodynamics. For a chemical change occurring between pure crystalline solids at absolute zero, there is no change in entropy.

■ **Neutrino**

It is an elementary particle having rest-mass zero and is electrically neutral. It has a spin of 1/2.

■ **Neutron bomb**

It is a nuclear bomb. It releases a shower of life destroying neutrons but has practically little blast and contamination.

■ **Newton**

It is S.I. unit of force. It is equal to the force which produces an acceleration of 1 m/s² in a mass of 1 kg.

■ **Newton's formula for velocity of sound :**

$$u = \sqrt{\frac{E}{\rho}} \quad \text{where } u = \text{velocity of sound} \quad E = \text{Elasticity of medium}$$

$$\rho = \text{density of medium}$$

■ **Newton's law of cooling**

According to it, the rate of loss of heat from a hot body is directly proportional to the excess of temperature over that of its surroundings, provided the excess of temperature is not very large.

■ **Newton's law of gravitation**

Every body in this universe attracts every other body with a force which is directly proportional to the product of their masses and inversely proportional to the square of the distance between them.

$$\text{Mathematically } F \propto \frac{m_1 m_2}{r^2}; F = G \frac{m_1 m_2}{r^2}$$

■ **Newton's law of motion**

- **Ist Law :** A body continues to remain in its state of rest or of uniform motion in the same direction in a straight line unless acted upon by some external force.
- **IInd Law :** The rate of change of momentum of a body is directly proportional to the implied force & takes place in the direction of the force $F = \frac{dp}{dt} = ma$
- **IIIrd Law :** To every action there is equal and opposite reaction. $\vec{F}_{12} = -\vec{F}_{21}$

■ **Newton's ring**

Refers to alternately dark and bright fringes (circular) that can be observed around the point of contact of a convex lens and a plane reflecting surface. These are produced due to interference of light waves reflected at the upper and lower surfaces of the air film separating the lens and the plane surface.

■ **Nichrome**

An alloy of nickel, chromium and iron. It has high melting point and large resistivity. It is used for electric resistors and heating element.

■ **Nicol prism**

A prism made of calcite. It is used for polarizing light and analysing plane polarised light.

■ **Normal temperature and Pressure (N.T.P.)**

These are 273 K and 760 mm of mercury respectively.

■ **Nuclear fission**

A nuclear reaction in which an atomic nucleus breaks up into two nearly equal fragments and evolution of a large amount of energy.

■ **Nuclear fusion**

A nuclear reaction in which two light nuclei combine to form a heavier nuclei and evolution of a large amount of energy.

■ **Nuclear force**

It refers to the strong attractive force that keeps (bind) a large number of nucleons bound together in a very small space. It is a short range attractive force and is charge independent. Its range is a few fermi. (1 fermi = 10^{-15} m)

■ **Nuclear Magnetic Resonance (NMR)**

The absorption of electromagnetic radiation at a suitable precise frequency by a nucleus with a nonzero magnetic moment in an external magnetic field. The phenomenon occurs if the nucleus has nonzero "spin", in which case it behaves as a small magnet. In an external magnetic field, the nucleus's magnetic moment vector precesses about the field direction but only certain orientations are allowed by quantum rules. Thus for hydrogens (spin of $\frac{1}{2}$) there are two possible states in the presence of a field, each with a slightly different energy. Nuclear magnetic resonance is the absorption of radiation at a photon energy equal to the difference between these levels causing a transition from a lower to a higher energy state.

■ **Nuclear mass**

It is equal to the sum of masses of protons and neutrons minus the mass defect. Mass of nucleus = $Z M_p + (A - Z) M_n - \Delta m$

Z = Atomic number = number of protons

A = Mass number or = number of protons + number of neutrons

M_p = Mass of proton

M_n = Mass of neutron Δm = Mass defect

■ **Nucleons**

Refers to protons and neutrons which are present in the nucleus. They are collectively called nucleons.

■ **Octave**

The interval between two musical notes whose frequencies are in the ratio of 2 : 1

■ **Octet**

Group of eight electrons that constitute the outer electron shell in case of an inert gas (except helium) or any other atom/ion.

■ **Odd-Odd nucleus**

A nucleus which contains the odd number of protons and odd number of neutrons.

■ **Oersted**

A.C.G.S. unit for magnetic field strength $1 \text{ Oersted} = \frac{10^3}{4\pi} \text{ A/m.}$

■ **Ohm's law**

It states "current flowing through a conductor is directly proportional to the potential difference across its ends. If temperature and other physical conditions remain unchanged".

■ **Opacity**

It is the reciprocal of the transmittance of a substance. It is a measure of the extent to which a substance is opaque.

■ **Opaque**

A substance that is not transparent or which does not allow light to pass through it.

■ **Optical activity**

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It is the property of certain substance to rotate the plane polarized light when it passes through their solution. The substances are classified as dextro-rotatory or leavo rotatory depending on whether they rotate it towards right (dextro) or left (leavo). The rotation produced depends upon the length of the medium and concentration of the solution. It also depends on the wave length of light used.

■ **Optical pyrometer**

A pyrometer where in the luminous radiation from the hot body is compared with the from a known source. The instrument measures the temperature of a luminous source without thermal contact.

■ **Optimum**

Refers to most favourable conditions for obtaining a given result.

■ **Oscillation magnetometer**

It is an instrument where in a freely suspended magnet is made to vibrate in a magnetic field (of earth). The

time period of vibration of this instrument is given by $T = 2\pi \sqrt{\frac{I}{MB_H}}$.

■ **Overtones**

Refers to the tones or frequencies emitted by a system besides its fundamental frequency are called overtones. Generally the intensity of overtones is lower than that of the fundamental.

■ **Packing fraction**

The algebraic difference between the relative atomic mass of an isotope and its mass number divided by the mass number.

■ **Pair production**

It refers to the simultaneous production of an electron and its anti-particle (positron) from a gamma ray photon. The minimum energy that such a photon must have in 1.02 MeV.

■ **Paramagnetic**

Refers to the magnetic nature of substances. Paramagnetic substances are those substances in which the magnetic moments of the atoms have random directions until placed in a magnetic field. When placed in a magnetic field they possess magnetisation in direct proportion to the magnetic field and are weakly magnetised. If placed in a non-uniform magnetic field, they move from weaker parts to stronger parts of the field.

■ **Paraxial rays**

Refers to those incident rays which are parallel and close to the axis of a lens.

■ **Parent nucleus**

Any nucleus that undergoes radioactive decay to form another nucleus. The nucleus resulting by radioactive decay of the parent nucleus is called daughter nucleus.

■ **Parsec**

It is an astronomical unit of distance 1 parsec = 3.0857×10^{16} m or 3.2616 light years. It corresponds to a parallel of one second of arc. The distance at which the mean radius of the earth's orbit subtends an angle of one second of arc.

■ **Pascal (Pa)**

The S.I. unit of pressure 1 Pa = 1 Newton/metre²

■ **Pascal's Law**

In a confined fluid, externally applied pressure is transmitted uniformly in all directions.

■ **Pauli's exclusion principle**

It states, "No two electrons in an atom can have all the quantum numbers same".

■ **Peak value of inverse voltage (PIV)**

It is the maximum instantaneous voltage that applied to a device, particularly rectifiers, in the reverse direction.

■ **Penumbra**

The partial shadow that surrounds that complete shadow of an opaque body.

■ **Perfect gas**

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An ideal gas that obeys the gas laws at all temperatures and pressure. It consists of perfectly elastic molecules. The volume of molecules is zero and the intermolecular forces of attraction between them is also zero.

■ **Perigee**

It is the shortest distance of a satellite from the earth.

■ **Perihelion**

The point in the orbit of a planet, comet or artificial satellite in solar orbit at which it is nearest to the sun. The earth is at perihelion on about 2 January

■ **Periscope**

An optical device used to view objects that are above the level of direct sight or are in an obstructed field of vision. In its very simple form it is made up of two mirrors inclined at 45° to the direction being viewed.

■ **Permalloys**

A group of alloys of high magnetic permeability consisting of iron and nickel (usually 40-80%) often with small amounts of other element (eg., 3 – 5% molybdenum, copper, chromium or tungsten. They are used in this foils in electronic transformers, for magnetic shielding and in computer memories.

■ **Permanent magnet**

A magnet that retains its magnetism even after the removal of external magnetic field.

■ **Permeability (μ)**

When a magnetic substance is placed in a uniform magnetic field (where lines of force are parallel) number of lines of force are seen to be crowded through the substance. The conducting power of the substance for the lines of force is called permeability. It is taken as unity for air. $B = \mu H$. It is measured in Henry/metre. The relative permeability of a substance is equal to the ratio of its absolute permeability to the permeability of the free space. Thus $\mu_r = \mu/\mu_0$. Where μ_0 , the permeability of free space has the value $4\pi \times 10^{-7}$ henry/meter.

■ **Persistence of vision**

The impression of an image on the retina of the eye for some time after its withdrawal is known as persistence of vision. The impression on human eye lasts for $1/16^{\text{th}}$ of a second. Successive images at the rate of 16 per second of the same scene give the impression of continuity.

■ **Phonon**

The phonon is a quantum of thermal of energy. It is given by hf , where h is the Planck constant and f the vibrational frequency. It refers to lattice vibration of crystals.

■ **Photodiode**

A semiconductor diode used to detect the presence of light or to measure its intensity. It usually consists of p – n junction device in a container that focuses any light in the environment close to the junction. The device is usually biased in reverse so that in the dark the current is small; when it is illuminated the current is proportional to the amount of light falling on it.

■ **Photo-electric effect**

When light of suitable wavelength falls on a metal plate, such as ultra violet light on zinc, slow moving electrons are emitted from the metal surface. This phenomenon is known as photoelectric effect and the electrons emitted are known as photoelectrons.

■ **Photo fission**

A nuclear fission that is caused by a gamma-ray photon.

■ **Photon**

Each quantum of light energy is known as photon. The energy of photon is given by $E = \frac{hc}{\lambda}$, where λ is the wavelength associated with the photon, c is velocity of light and h is Planck's constant.

■ **Photonuclear reaction**

A nuclear reaction that is initiated by a (gamma-ray) photon.

■ **Photo sphere**

It refers to highly luminous and visible portion of the sun. The approximate temperature existing in photosphere is estimated to be about 6000 K.

■ **Piezo electric effect**

The product of a small e.m.f. across the opposite faces of non conducting crystals when they are subjected to mechanical stress between their faces external pressure is known as piezoelectric effect or piezoelectricity.

■ **Plank's formula for black-body radiation**

The energy radiated per unit time per unit area at a given wavelength λ , is given by $E = \frac{2\pi hc^2}{\lambda^5 (e^{\frac{hc}{\lambda kT}} - 1)}$.

where c is the speed of light, h is Planck's constant and T is the absolute temperature of the black body, k is the Boltzmann's constant.

■ **Plane of polarisation**

It is a plane that is perpendicular to the plane of vibration and containing the direction of propagation of light. It is also the plane containing the direction of propagation and the electric vector of the electromagnetic light wave.

■ **Plasma**

A highly ionized gas in which the number of free electrons is approximately equal to the number of positive ions. Sometimes described as the fourth state of matter, plasmas occurs in interstellar space, in the atmosphere of stars (including the sun), in discharge tubes and in experimental thermonuclear reactors.

■ **Poise**

It is a unit of viscosity in C.G.S. system. $1 \text{ Poise} = 0.1 \text{ Ns/m}^2$.

■ **Poiseuille's formula**

It gives the volume per unit time flowing through a cylindrical tube carrying a laminar flow. $Q = \frac{\pi R^4 \Delta P}{8\eta \ell}$

where; Q = Volume per unit of time

R = Radius of pipe

ℓ = Length of the pipe

ΔP = Pressure difference across each end of pipe

η = Coefficient of viscosity

■ **Poisson's ratio**

The ratio of the lateral strains to the longitudinal strain in a stretched rod. If the original diameter of the rod is d and the contraction of the diameter under stress is Δd , the lateral strain $\Delta d/d = s_d$; if the original length is ℓ

and the extension under stress $\Delta \ell$, the longitudinal strain is $\frac{\Delta \ell}{\ell} = s_\ell = s$. Poisson's ratio is then s_d/s_ℓ .

■ **Polaroid**

Synthetic material that are used for producing polarized light from unpolarised light by dichorism.

■ **Positive crystals**

Doubly refracting crystals in which the ordinary ray travels faster as compared to an extra ordinary ray e.g., quartz.

■ **Positron**

An elementary particle having a mass equal to that of an electron and carrying a unit positive charge.

■ **Positronium**

An unstable assembly of a proton and an electron. It decays into a photon.

■ **Potentiometer**

It is a device that is used for measuring electromotive force or potential difference by comparing it with a known voltage.

■ **Pound**

A unit of mass FPS system 1 pound = 453.59 g

■ **Poundal**

A unit of force FPS system 1 poundal = 0.138 N

■ **Power of a lens**

It is the ability of a lens to bend the rays passing through it. Power of convex lens is positive and that of concave lens is negative. Units of power of lens = Diopetre power = $\frac{1}{\text{Focal length in meters}}$

■ **Power reactor**

A nuclear reactor designed to produce electrical power.

■ **Presbyopia**

It is a defect of vision. Any one suffering with this defect cannot see the near objects. This defect is generally observed in older people. It can be corrected with the help of convex lenses.

■ **Pressure gauge**

It is an instrument that is used for measuring the pressure of a gas or a liquid.

■ **Prime meridian**

The Greenwich meridian. It is used as standard for reckoning longitude east or west.

■ **Principle of floatation**

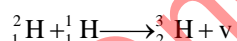
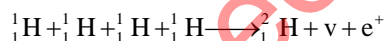
A body floats as a liquid when the weight of the liquid displaced by it is equal to its weight.

■ **Prompt neutrons**

The neutrons emitted during a nuclear fission process within less than a microsecond of fission.

■ **Proton-Proton cycle.**

It refers to a chain of nuclear fusion reactions which are thought to be responsible for production of energy in the sun. Hydrogen gets converted into helium.



■ **Pulsar**

A celestial source of radiation emitted in brief (0.03 second to 4 seconds) regular pulses. First discovered in 1968, a pulsar is believed to be a rotating neutron star. The strong magnetic field of the neutron star concentrates charged particles in two regions and the radiation is emitted in two directional beams. The pulsing effect occurs as the beams rotate. Most pulsars are radio sources (emit electromagnetic radiation of radio frequencies) but a few that emit light or X-rays have been detected. Over 300 pulsars are now known, but estimated that there are over one million in the Milky way.

■ **Pyrometer**

It is an instrument that is used for measurement of very high temperature. The measurement is done by observing the colour produced by a substance by heating or by thermoelectric means.

■ **Quantity of sound**

Majority of musical notes contain more than one frequency. Quantity of sound is a characteristic of a musical note that depends on frequencies present in the note. In each note there is one fundamental frequency and a number of overtones. The frequencies of overtones are integral multiples of the fundamental frequency, but intensity is much low. The quality of sound changes with the number of overtones present and their intensity.

■ **Quark**

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Hypothetical fundamental particles which are postulated to be building blocks of elementary particles.

■ **Quartz**

The most abundant and common mineral, consisting of crystallin silica (silicon dioxide, SiO_2).

■ **Quartz clock**

A clock based on a piezoelectric crystal of quartz.

■ **Quasars**

A class of astronomical objects that appear on optical photographs as star like but have large redshifts quite unlike those of stars.

■ **Quenching**

The rapid cooling of a metal by immersing it in a bath of liquid in order to improve its properties.

■ **Q-value**

It is the amount of energy produced in a nuclear reaction. It is expressed in MeV.

■ **Rad**

The unit of absorbed radiation. One rad = absorption of 10^{-2} joule of energy in one kilogram of material.

■ **Radiology**

It is the branch of science that deals with X-rays or rays from radioactive substance.

■ **Radioscopy**

It involves the examination of opaque objects with the help of X-rays.

■ **Radius of curvature (R)**

In case of a mirror or a lens it is the radius of the sphere of which a mirror or lens surface is a part.

■ **Radius of gyration (K)**

It is the distance, from the axis of rotation of a body to a point where the whole mass of a body may be considered to be concentrated.

It is given by $K = \sqrt{\frac{I}{m}}$. Where I is the moment of inertia of body of mass m about the axis of rotation.

■ **Rainbow**

An arc of seven colours that appears in the sky due to splitting of sunlight into its constituent colours by the water droplets present in air because of refraction and internal reflection of sunlight by beam.

■ **Raman effect**

When monochromatic light is allowed to pass through a transparent medium it gets scattered and the scattered light contains original wave length as well as lines of larger wave length than the original lines. These lines of larger wave lengths are known as Raman lines and this effect is known as Raman effect. This is quite useful in the study of molecular energy levels of liquids.

■ **Rayleigh's criterion**

Two sources are just resolvable by an optical instrument if the central maximum of the diffraction pattern of one coincides in position with the first minimum of the diffraction pattern of the other.

■ **Receiver**

Any device or apparatus that receives electric signals, waves etc.

■ **Recoil**

Means to fly back

■ **Rectifier**

A device that allows the current to flow through it in one direction only. It can convert A.C. into D.C. The commonly used rectifiers are a p - n junction, a diode valve etc.

■ **Red giant**

It is a type of cool giant star that emits light in red region of the spectrum. A normal star expands to red giant

as it exhausts its nuclear fuel.

■ **Red shift :**

Because of **Doppler effect** a shift of spectrum lines in the spectra of some celestial objects towards the red end of the visible spectrum with an increase in wave length of the lines.

■ **Reflectance**

It is the ratio of the reflected light to the incident light on a surface.

■ **Reflecting power**

It is the ratio of the quantity of energy reflected to the quantity of energy falling on a body per unit time.

■ **Refrigerator**

It is the device that is used for producing low temperature and keeping items at low temperature.

■ **Relative humidity**

The amount of water vapour in the air, expressed as a percentage of the maximum amount that the air could hold at a given temperature.

■ **Relativistic mass**

It is the mass of an object which is moving with a velocity v .

It is given by the relation
$$m = \frac{m_0}{\sqrt{1 - \frac{v^2}{c^2}}}$$

where m_0 is the rest mass of the same object.

■ **Relativistic particle**

A particle moving with a velocity close to the velocity of light, say greater than $0.1c$, c being the velocity of light.

■ **Remanence**

The magnetic flux which remains in a magnetic circuit even after the applied magnetomotive force is removed.

■ **Remote sensing**

The gathering and recording of information concerning the earth's surface by techniques that do not involve actual contact with the object or area under study. These techniques include photography (e.g., aerial photography), multispectral imagery, infrared imagery and radar. Remote sensing is generally carried out from aircraft and increasingly, satellites. The techniques are used, for example, in cartography (map making)

■ **Resistance**

It is the property of a material by virtue of which it opposes the flow of current through it. $R = V/I$

■ **Resistance box**

It is a box containing a set of combination of resistance coils arranged in such a way that any desired value of resistance may be obtained using one or a combination of these.

■ **Resistivity (ρ)**

It is also known as specific resistance. It is defined as the resistance offered by 1 m length of the conductor having an area of cross-section of 1 square meter.

Units of ρ are ohm-meter or ohm-cm.

■ **Resolving power :**

It gives the measure of the ability of an optical instrument to form separate and distinguishable images of two objects very close to each other. The resolving power of a telescope is given by

$$\text{Resolving power} = \frac{1.22\lambda}{a}$$

Where λ is the wavelength of light used and a is the aperture.

■ **Retentivity**

It is the ability to retain magnetisation even after the magnetising force is removed.

■ **Reverberation**

Refers to the persistence of sound even after the source has stopped emitting the sound.

■ **Reverberation time**

It is the time taken by a sound made in a room to diminish by 60 decibels.

■ **Reynold number**

It determines the state of flow of liquid through a pipe. According to Reynold number the critical velocity (v_c)

is given by $v_c = \frac{R_n \eta}{\rho D}$ where ρ is the density of liquid, R_n is Reynold number and D is the diameter of the pipe

through which liquid is flowing -

If R_n is upto 1000 the flow is streamline or laminar.

If R_n lies between 1000-2000, flow is unstable.

If R_n is more than 2000, flow is turbulent.

■ **Richter scale**

A logarithmic scale devised in 1935 by C.F. Richter (1900) to compare the magnitude of earthquakes. The scale ranges from 0 to 10. On this scale a value of 2 can just be felt as a tremor and damage to buildings occurs for values in excess of 6. The largest shock recorded had a magnitude of 8.9.

■ **Roentgen (R)**

It is a unit of ionising radiation. One, Roentgen induced 2.58×10^{-4} C of charge per kilogram of dry air.

■ **Roentgen rays**

X-rays

■ **Rutherford**

It is defined as the amount of radioactive substance which gives rise to 10^6 disintegrations per sec.

1 curie = 3.7×10^{10} Rutherford.

■ **Rydberg constant**

The wavelength of lines of an atomic spectra are given by $\frac{1}{\lambda} = R \left(\frac{1}{n_1^2} - \frac{1}{n_2^2} \right)$ where n_1 and n_2 are integers, R

is called Rydberg's constant $R = \frac{2\pi^2 m e^4}{ch^3}$.

■ **Scattering**

It is the phenomenon of spreading out or diffusion of a beam of radiation when it is incident on some matter surface. The intensity of scattered light varies as $1/\lambda^4$ (Rayleigh scattering)

■ **Schwartzchild radius**

It is equal to $2GM/c^2$, where G is the gravitational constant, c is the speed of light and M is the mass of the body. If the body collapse to such an extent that its radius is less than the Schwartzchild radius the escape velocity becomes equal to the speed of light and the object becomes a black hole.

■ **Scintillated**

To twinkle like stars.

■ **Scintillation**

Refers to the twinkling effect of the light of stars.

■ **Second pendulum**

A simple pendulum having a time period of two seconds.

■ **Seeback effect**

When the junctions of two metallic conductors are maintained at different temperature and e.m.f. is produced across these junctions. The production of such an e.m.f. is known as seeback effect.

■ **Segre chart**

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A graph wherein the number of protons in nuclides is plotted against the number of neutrons.

■ **Seismograph**

An instrument that records ground oscillation. e.g., those caused by earthquakes volcanic activity and explosions.

■ **Semi-conductor**

A substance having conductivity more than an insulator but less than that of a conductor. The conductivity of a semiconductor increases with temperature. Pure semi-conductors are also known as intrinsic semi-conductors. It is possible to increase the conductivity of a semi-conductor by adding suitable impurities in them. Such semi-conductors are known as extrinsic semi-conductors.

■ **Semipermeable membrane**

A membrane that is permeable to molecule of the solvent but not the solute in osmosis. Semipermeable membranes can be made by supporting a film of material (e.g., cellulose) on a wire gauze of porous pot.

■ **Sextant**

It is an optical instrument. It is used for the determination of the dimensions and distances of distant object. It is based on the principle that if the angle subtended by two ends of an object at the observer's eye is known (measured by the sextant), the distance and dimensions of the object can be determined with the help of a trigonometric formula.

■ **Shadow**

It refers to the dark shape cast on a surface by an object through which light, a form of radiation, can not pass, as radiations, travel in a straight line through a given medium. If one of the sources of radiations is small and the object is large, sharp shadow is formed. However if the sources is large than the object, the shadow formed is not sharp and shows two distinct regions. The umbra or full shadow at the centre, surrounded by penumbra or partial shadow, no radiation reaches umbra but some radiation reaches penumbra.

■ **Short wave**

Refers to an electromagnetic wave of 60 meters or less.

■ **Side band**

Range of frequencies on either side of the carrier frequency of a modulated signal. The width of a side-band both above and below the modulated wave is equal to the highest modulating frequency.

■ **Siemens (Mho)**

It is S.I. unit of electrical conductance 1 Siemen (1 Mho) = 1 A/V.

■ **Significant figure**

The number of digits used in a number specify its accuracy. The number 6.532 is a value taken to be accurate to four significant figures. The number 7320 is accurate only to three significant figure. Similarly 0.0732 is also only accurate to three significant figure. In these cases the zeros only indicate the order of magnitude of the number, whereas 7.065 is accurate to four significant figures as the zero in this case is significant in expressing the value of the number.

■ **Silicon chip**

A single crystal of a semiconducting silicon material, typically having micrometer dimension, fabricated in such a way that it can perform a large number of independent electronic function.

■ **S.I. units**

This is international system of units comprising of seven basic units. These are :

Physical Quantity	Unit	Symbol
Length	Metre	m
Mass	Kilogram	kg
Time	Second	s
Temperature	Kelvin	K
Electric current	Ampere	A
Light intensity	Candela	cd

Amount of substance	mole	mol
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■ **Skin effect**

It is the phenomenon wherein an alternating current tends to concentrate in the outer layer of a conductor.

■ **Skip distance**

The minimum distance at which a sky wave can be received. This arises due to a minimum angle of incidence at the ionosphere below which a sky wave is not reflected. This minimum angle is a function of the frequency.

■ **Sky wave**

Refers to a radio wave that is propagated upwards from the earth and such a wave reaches a point after reflection from the ionosphere and not directly from the transmitter.

■ **Snell's law**

$$\mu = \frac{\sin i}{\sin r} \text{ (or } \mu \sin \theta = \text{constant)}$$

■ **Soft iron**

It refers to iron that contains small quantities of carbon. Since it can be easily magnetised and demagnetised easily so it is used in transformers, electric bell etc.

■ **Solar battery**

It is device for converting solar energy into electricity by means of photo voltaic cells.

■ **Solar constant**

It refers to the average rate at which solar energy is received from the sun by the earth. It is equal to 1.94 small calories per minute per square centimeter of area perpendicular to the sun's rays. It is equal to 1400 J/s-m².

■ **Solar day**

The time interval that elapses between two successive appearances of the sun at the meridian.

■ **Solar system**

The sun, the nine major planets (Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune and Pluto) and their natural satellites, the asteroids, the comets and meteoroids. Over 99% of the mass of the system is concentrated in the sun. The solar system as a whole moves in an approximately circular orbit about the centre of the galaxy, taking about 2.2×10^8 years to complete its orbit.

■ **Solar wind**

A continuous outward flow of charged particles, mostly protons and electrons from the sun's corona into interplanetary space. The particles are controlled by the sun's magnetic field and are able to escape from the sun's magnetic field and are able to escape from the sun's gravitational field because of their high thermal energy. The average velocity of the particles in the vicinity of the earth is about 450 km s⁻¹ and their density at this range is about 8×10^6 protons per cubic metre.

■ **Solenoid**

It refers to a coil of wire wound over a cylindrical frame uniformly. Its diameter is small as compared to its length. When a current is passed through it, a magnetic field is produced inside the coil and parallel to its axis. It can also be used as an electromagnet by introducing a core of soft iron inside it.

■ **Sonic boom**

Refers to a loud noise.

■ **Sonometer**

It is an instrument that is used for studying the vibrations of a fixed wire or string. It consists of a hollow wooden box with a stretched across its top. The wire is fixed at one end while the other end passes over a pulley and a load can be suspended from it. Any length of wire can be set into vibration by placing two inverted v-shaped bridges at the ends, by placing vibrating tuning fork on the sonometer. Resonance is

produced when the natural frequency of the vibrating wire given by $\left(f = \frac{1}{2\ell} \sqrt{\frac{T}{m}} \right)$ is equal to the frequency of

the tuning fork. T is the tension in the wire and m is the mass per unit length.

■ **Space-charge**

A region in a vacuum tube or semi-conductor having some net electric charge because of excess or deficiency of electrons.

■ **Specific gravity**

It is the ratio of density of any substance to the density of some other substance taken as standard. e.g., the density of water at 4°C is taken as 1.

■ **Specific heat**

It is the amount of heat required to raise the temperature of 1kg of substance by 1°C or 1°K .

It is expressed in J/g/K or $\text{J Kg}^{-1} \text{K}^{-1}$.

The specific heat of water is maximum.

■ **Spectrograph**

An instrument where in a photograph of the spectrum can be obtained.

■ **Spectrometer**

It is an instrument that is used for analysing the spectrum of a source of light.

■ **Spherical aberration**

A defect of image due to the paraxial and marginal rays which are coming to focus at different point on the axis of the lens. It can be corrected by using parabolic surface and refractors.

■ **Spontaneous fission**

Nuclear fission that occurs independently of external circumstances and is not initiated by the impact of an neutron, an energetic particles or a photon.

■ **Spring balance**

Any instrument with which a force is measured by the extension produced in a helical spring. It is used in weighing. The extension produced is directly proportional to the force (weight).

■ **Stable equilibrium**

A body is said to be in stable equilibrium if it tends to returns to its original state when it is slightly disturbed from its state.

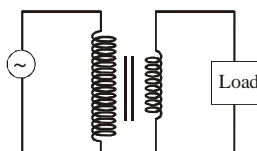
■ **Steam point**

It is the temperature at which water boil under a pressure of one atmosphere.

■ **Step-down transformer**

It helps in stepping down the

voltage. In it $N_s < N_p$ and so $\frac{N_s}{N_p} < 1$.

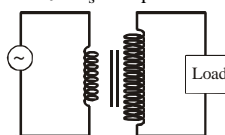


The e.m.f. of secondary coil is less than that of primary $E_s < E_p$.

■ **Step-up transformer**

It helps in stepping up the voltage.

In it $N_s > N_p$ and the $\frac{N_s}{N_p} > 1$. The e.m.f. of secondary



coil is greater than that of primary $E_s > E_p$.

■ **Stokes (St)**

It is a unit of viscosity in C.G.S. system.

■ **Stoke's law**

When a spherical body falls through a viscous medium, it drags the layer of fluid in contact. Due to relative motion between layers, the falling body feels a viscous force F given by $F = 6 \pi \eta r v$

Where r = radius of body

v = velocity of body

η = Coefficient of viscosity

■ **Sublimation**

Change from solid to gaseous state without passing through liquid state.

■ **Subsonic**

Speed less than the speed of sound.

■ **Sunspots**

Dark patches observed on the sun's surface that are regions of cool gas. Their presence is connected with local changes in the sun's magnetic field. They appear in cycles having a period of about 11 years.

■ **Super conductivity**

Refers to complete disappearance of electrical resistance. It has been observed in some substances when they are cooled to very low temperatures (very close to absolute zero). This phenomenon can be used for producing large magnetic fields.

■ **Surface tension**

It is the force per unit length of an imaginary line drawn in the liquid surface in equilibrium acting perpendicular to it at every point and tending to pull the surface part along the line. It can also be defined as the work done in increasing the surface area of a liquid film by unity. Units of surface tension are dynes/cm or N/m.

■ **Susceptibility**

If a bar of iron is placed in a magnetic field, it gets magnetised and the pole strength or magnetisation depends upon the strength of magnetic field. Thus if \vec{H} is magnetic intensity or magnetizing field intensity and \vec{I} is

intensity of magnetization then $\frac{I}{H} = \chi$ is the susceptibility of the specimen. The value of χ (susceptibility) and μ (permeability) are high for ferromagnetic substances.

■ **Synchronous orbit or geosynchronous orbit**

An orbit of the earth made by an artificial satellite with a period exactly equal to the earth's period of rotation on its axis. i.e., 23 hours 56 minutes 4.1 seconds. If the orbit is inclined to the equatorial plane the satellite will appear from the earth to trace out a figure-of-eight track once over 24 hours. If the orbit lies in the equatorial plane and is circular, the satellite will appear to be stationary. This is called a stationary orbit (or geostationary orbit) and it occurs at an altitude of 35900 km. Most communication satellites are in stationary orbits, with three or more spaced round the orbit to give worldwide coverage.

■ **Telestar**

It refers to one of a series of low latitude, active communication satellites for broad band microwave communication and satellite tracking in space.

■ **Temperature gradient**

Rate of change of temperature with distance.

■ **Temperature scale**

Any temperature scale consists of two fixed points which generally correspond to easily reproducible systems. These are assigned certain definite values and the interval between them is divided into an equal number of parts. The Celsius scale is most commonly used and the fixed point in it are the ice point (0°C) and steam point (100°C). Interval between them is divided into 100 equal parts, each part being equal to 1°C , other scale used are, Fahrenheit, Romer and Kelvin. These are related to Celsius scale as -

$$\frac{C}{100} = \frac{F - 32}{180} = \frac{R}{80} = \frac{K - 273}{100}$$

■ **Tempering**

It refers to the process used for increasing the toughness of an alloy by heating it to a predetermined temperature, maintaining it at this temperature for predetermined time and then cooling it to room temperature at a predetermined rate.

■ **Tensile strength**

The resistance of a material to longitudinal stress. It is measured by minimum amount of longitudinal stress needed to break the material.

■ **Terminal speed**

The constant speed finally attained by a body moving through a fluid under gravity when there is a zero resultant force acting on it. See Stokes's law.

$$v_0 = \frac{2r^2(\rho - \rho')g}{9\eta}$$

Where ρ = Density of spherical body and ρ' = Density of fluid

If $\rho > \rho' \Rightarrow$ the body will move downward.

If $\rho < \rho' \Rightarrow$ the body will move upward.

■ **Thermal capacity or Heat capacity**

It is the amount of heat required to raise the temperature of a body by 1°C . It is equal to the product of mass of the body and the specific heat. It is expressed in Joule/ $^\circ\text{C}$ or Joules/K.

■ **Thermal diffusion**

It refers to the diffusion that occurs in a fluid due to temperature gradient. It is used to separate heavier gas molecules from lighter ones by maintaining a temperature gradient over a volume of gas containing particles of different masses. This method is also used to separate gaseous isotopes of an element.

■ **Thermal neutrons**

Refers to neutrons of very low speed and energy (≈ 0.1 eV)

■ **Thermal reactor**

It is a type of nuclear reactor in which the nuclear fission reactions are caused by thermal neutrons.

■ **Thermion**

Refers to an ion that is emitted by an incandescent material.

■ **Thermionic current**

It refers to the electric current that is produced due to flow of thermions.

■ **Thermionic emission**

It refers to the emission of electrons from the surface of a substance when it heated. It forms the basis of the thermionic valve and the electron gun in cathode ray tubes. The emitted density is given by Richardson-Dushman equation $J = AT^2 e^{-\phi/kT}$

Where T = Thermodynamic temperature of the emitter

ϕ = Work function

k = Boltzmann constant

A = Some constant

■ **Thermistor**

It refers to a semi-conductor, whose electrical resistance changes rapidly with change in temperature. It is used to measure temperature very accurately.

■ **Thermocouple**

It consists of two metallic junctions of different metal whose junctions are kept at different temperature, an e.m.f. develops across these which is proportional to the temperature difference. A measurement of e.m.f. enables one to calculate the temperature so it is used for measurement of temperature.

■ **Thermo e.m.f.**

Seebeck discovered that if two dissimilar metals are joined together to form a closed circuit and their two junctions are maintained at different temperatures an e.m.f. is developed and an electric current flows in the

circuit. This e.m.f. developed is known as thermo e.m.f. is given by $E = \alpha t + \frac{1}{2} \beta t^2$.

Where t = temperature difference of hot and cold junctions in $^{\circ}\text{C}$, α and β are constants which are characteristic of metal forming the thermocouple and are known as seebeck coefficients.

■ **Thermoelectricity**

The electricity produced due to thermo e.m.f. is called thermoelectricity.

■ **Thermoelectric power**

It refers to the rate of change of the thermo e.m.f. of the thermocouple with the temperature of the hot junction.

■ **Thermopile**

It is an arrangement of thermocouple in series. Such an arrangement is used to generate thermoelectric current or for detecting and measuring radiant energy.

■ **Thermostat**

A device which is used to keep the temperature in a place within in a particular range. Thermostats present in a number of common household devices such as cookers, refrigerators, irons, freezers and heating boilers. Mainly thermostats are **biometallic strips**.

■ **Threshold**

It refers to the minimum value of a parameter that will produce a specified effect.

■ **Threshold of hearing**

That minimum intensity level of a sound wave which is audible. It occurs at a loudness of about 4 phons.

■ **Timbre**

The characteristic quality of sound. It is independent of pitch and loudness but depends upon the relative strength of components of different frequencies, determined by resonance. It depends on the number and intensity of the overtones present.

■ **Tomography**

The use X-rays to photograph a selected plane of a human body with other planes eliminated. The CAT (computerised axial tomography) scanner is a ring-shaped X-ray machine that rotates through 180° around the horizontal patient, making numerous X-ray measurements every few degrees. The vast amount of information acquired is built into a three-dimensional image of the tissues under examination by the scanner's own computer. The patient is exposed to a dose of X-rays only some 20% of that used in a normal diagnostic X-ray.

■ **Ton**

It is a unit of weight 1 ton = 2000 pounds.

■ **Tone**

It refers to a sound considered with reference to its quality, strength source etc.

■ **Tonne**

A unit of mass 1 Tonne = 10^3 kg.

■ **Torr**

A unit of pressure. 1 torr = 1333.2 microbars. One torr is equal to the pressure of 1 mm. of mercury.

■ **Torricelli's theorem**

It gives us the velocity of a fluid, coming out of a vessel, at a point at a height h below its surface. According to it. $v = \sqrt{2gh}$

■ **Torsion**

It refers to the twisting of an object by two equal and opposite torques.

■ **Torsional pendulum**

In such a pendulum moment of restoring forces, $\tau = -k\theta$

Time period $T = 2\pi \sqrt{\frac{I}{K}}$ where

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K = Constant torsion in the thread

I = Moment of inertia of the rotating body about the thread.

■ **Torsional Balance**

An instrument for measuring very weak forces. It consists of a horizontal rod fixed to the end of a vertical wire or fibre or to the centre of a taut horizontal wire. The forces to be measured are applied to the end or ends of the rod. The turning of the rod may be measured by the displacement of a beam of light reflected from a plane mirror attached to it.

■ **Total internal reflection**

For such a reflection the ray must pass from a denser to a rarer medium. When a ray of light travels from a more refractive medium to a less refractive medium it undergoes total internal reflection, if angle of incidence is greater than critical angle θ , which can be defined as

$$\sin\theta = \frac{n_1}{n_2} = {}^1n_2$$

■ **Transmitter**

- The equipment used to generate and broadcast radio-frequency electromagnetic waves for communication purposes. It consists of a carrier-wave generator, a device for modulating the carrier wave in accordance with the information to be broadcast, amplifiers and an aerial system.
- The part of a telephone system that converts sound into electrical signals.

■ **Trajectory**

It is the path traversed by a projectile, rocket etc.

■ **Trans-conductance**

It is the ratio of change in plate current to change in grid voltage at constant plate voltage. It is expressed in mhos.

■ **Transducers**

Refers to a device that receives energy from one source and retransmit it in a different form to another system or media.

■ **Transformer**

It is a device that is used to convert a large alternating current at low voltage into a small alternating current at high voltage or vice-versa.

■ **Transients**

It refers to the non-periodic portion of a wave or signal transient modulation. i.e., a modulation of temporary nature.

■ **Transmutation**

The process whereby one nuclide is converted into another nuclide.

■ **Transponder**

Refers to a radio or radar receiver, that automatically transmits a reply promptly on reception of a certain signal.

■ **Triangle law of vectors**

It states "if two vectors can be represented in magnitude and direction by two sides of triangle taken in order, then the resultant vector can be represented in magnitude and direction by the third side of the triangle taken in opposite order." Where \vec{a} , \vec{b} are two vectors and \vec{c} is the resultant vector $\vec{c} = \vec{a} + \vec{b}$.

■ **Triple point**

It is the temperature at which the gas, liquid and solid phase of a substance can coexist. Triple point of water is 273.16 K and 0.46 cm of mercury. All the three phases of water (solid, liquid and gas) coexist at this temperature and pressure and all the phases are equally stable.

■ **Triton**

Nucleus of tritium (${}^3\text{H}$) atom.

■ **Troposphere**

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It is the region of atmosphere which extends upto a height of about 16 km above the earth's surface at the equator and to a height of about 8 km at the poles. The temperature in this region decreases with increases in height.

■ **Tunnel diode**

A semiconductor diode, based on the tunnel effect. It consists of a highly doped p-n semiconductor junction, which short circuits with negative bias and has negative resistance over part of its range when forward biased. Its fast speed of operation makes it a useful device in many electronic fields.

■ **Tunnel effect**

An effect in which electrons are able to tunnel through a narrow potential barrier that would constitute a forbidden region if the electrons were treated as classical particles.

■ **Turbulent flow**

Flow of liquid wherein the speed of the fluid changes rapidly in magnitude and direction. The motion of a fluid becomes turbulent when its speed increases beyond a certain typical speed.

■ **Twilight**

The soft diffused light from the sky when the sun is below the horizon.

■ **Tyndall effect**

It refers to the scattering of light by particles in its path and the beam of light becomes visible.

■ **Umbra**

It is the region of complete shadow.

■ **Uncertainty principle**

It states, "It is not possible to find accurately and simultaneously both the position and velocity of a moving particle." Mathematically $\Delta x \cdot \Delta p = \frac{h}{4\pi}$

Where Δx = Uncertainty in position, Δp = Uncertainty in momentum

■ **Unipolar transistor**

A transistor wherein current flow is due to the movement of majority carriers only.

■ **Upthrust**

Refers to the upward force that acts on an object when it is immersed in a fluid. It is equal to the weight of fluid displaced by the object.

■ **Vacuum**

A space that is totally devoid of matter. Generally it refers to a space from which air has been removed and where the pressure is very low.

■ **Valence band**

Range of energies in a semi-conductor which corresponds to energy state that can be occupied by the valency electrons in the crystal.

■ **Van-de-graff accelerator**

It is a machine that is used to accelerated charged particles.

■ **Vander wall's equation of state**

It is an equation of state for real gases.

$$\left(P + \frac{n^2 a}{V^2} \right) (V - nb) = nRT$$

Where V = Volume of gas
 R = Gas constant
 T = Absolute temperature
 n = Number of moles of gas
 a, b = constant called Vander Wall's constant.

■ **Vander wall forces**

These are very weak attractive forces that exist between the atoms and molecules of all the substances. These are short range forces and arise due to molecular dipoles.

■ **Venturimeter**

It is an apparatus used to find the rate of flow of liquids when the motion of fluid is steady and non-turbulent.

■ **Vernier**

A small movable device having graduated scale running parallel to the fixed graduated scale of a sextant. It is used for measuring a fractional part of one of the fixed division of the fixed scale. The smallest measurement which can be made using a vernier instrument is equal to the difference between 1 main scale division (smallest) and 1 vernier scale division.

■ **Vernier caliper**

A caliper made up of two pieces sliding across one another, one having a graduated scale and the other a vernier.

■ **Viscosity**

It is the property of the fluid by virtue of which it opposes the relative motion between its different layers. It is also called internal friction of the fluid.

■ **Visible radiation**

Radiation in the wave length range of 3800-7600 Å. It is visible to human eye.

■ **Visual Display Unit (VDU)**

The part of a computer system or word processor on which text or diagrams are displayed. It consists of a cathode-ray tube and usually has its own input keyboard attached.

■ **Voltage stabilizer**

A device or circuit to maintain a voltage at its output terminals that is substantially constant and independent of other changes in the input voltage or in the load current.

■ **Voltaic Cell**

A cell having two electrodes of different metals dipped in the solution of their soluble salts and arranged in such a way that they produce an electromotive force.

■ **Voltmeter**

It is an electrolytic cell and is used to carry out the process of electrolysis.

■ **Voltmeter**

It is an instrument that is used for measuring the potential difference across two points in a circuit. It is always connected in parallel across the desired points in an electrical circuit.

■ **Volume**

It refers to the space occupied by a body.

■ **Volumetric**

Refers to measurement by volume.

■ **Watt-meter**

It is an instrument that is used for measuring power consumed in an electric circuit.

■ **Wavelet**

A small wave.

■ **Water equivalent of a substance**

It is the amount of water that would need the same quantity of heat for being heated through the same range of temperature as required by the substance for being heated through a given range of temperature.

■ **Wave-particle duality**

According to dual nature of matter, there is wave associated with every moving particle and vice-versa. The wavelength of a wave associated with a moving particle having a momentum p , is given by $\lambda = h/p$ where h is Planck's constant.

■ **Weber**

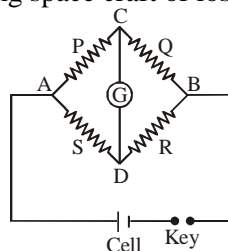
One weber is the magnetic flux linked with a surface of magnetic field one Tesla over an area of 1 sq meter.
 $1 \text{ Wb} = 1 \text{ Tm}^2$.

■ **Weightlessness**

It refers to the state, experienced by a person in an orbiting space craft of loss of weight.

■ **Wheatstone bridge**

It is an electrical circuit that is used to measure that electrical resistance. It consists of resistances connected in four arms. A galvanometer (G) is connected across two opposite junctions and a source of e.m.f. is connected across the remaining



two junctions as shown in the diagram. If three of the resistance P, Q, R are known, the fourth (S) can be determined. Keeping the resistance P, Q fixed the resistance R is varied till the galvanometer shows zero deflection. When this is achieved $\frac{P}{Q} = \frac{R}{S}$. For maximum sensitivity all the four resistances should be of the same order.

■ **White dwarf**

Refer to any of a large size of very faint stars that are considered to be in the last stage of stellar evolution. Its nuclear fuel is completely exhausted and it collapses, under its own gravitation, into a small but very dense body.

■ **Wiedemann-Franz law**

It states that for all metals, the ratio $\frac{k}{\sigma T} = \text{constant}$, where k is the thermal conductivity. σ is electrical conductivity and T is the absolute temperature of the substance.

■ **Wien's displacement law**

According to it, for a black-body radiation $\lambda_m T = \text{constant}$

Where λ_m = wavelength corresponding to maximum energy radiation.

T = Absolute temperature of the body.

■ **Wireless**

Means having no wire.

■ **Work Functions (ϕ)**

It is the minimum energy that is required to overcome the surface force so as to liberate the electrons from the metal surface. It is measured in electron volts.

■ **X-ray**

It is a form of electromagnetic radiation of shorter wavelength as compared to visible light. X-ray can penetrate through solid and can ionise gases.

■ **X-ray Diffraction**

The diffraction of X-rays by a crystal. The wavelengths of X-rays are comparable in size to the distance between atoms in most crystals and the repeated pattern of the crystal lattice acts like a diffraction grating for X-rays.

■ **Yard**

The former imperial standard unit of length. In 1963 yard was redefined as 0.91441 metre exactly.

■ **Yield point**

When a rod or wire of certain material is subjected to a slowly increasing tension, the point at which a small increase in tension produces a sudden and large increase in length is called the yield point.

■ **Zeeman effect**

It refers to the splitting up of single lines in a spectrum into a group of closely spaced lines. This effect is observed when the substance emitting the spectrum is placed in a strong magnetic field. The study of this effect is used in the study of atomic structure.

■ **Zener diode**

It is a semi-conductor diode where in each side of junction is highly doped. When the junction is reverse biased, a sharp increase in the current occurs at well defined potential. Such a diode is used as a voltage regulator.

■ **Zero-gravity**

It refers to the condition wherein the apparent effect of gravity becomes zero as on a body in orbit.

■ **Zero point energy**

It is the energy possessed by atoms or molecules of substance at absolute zero of temperature. It can not be explained by classical physics but has been accounted for as a quantum effect.

■ **Zeroth law of thermodynamics**

According to it, wherever two bodies A and B are in thermal equilibrium with another body C then bodies A and B will also be in thermal equilibrium with each other.

■ **Zero vector or Null vector**

A vector whose magnitude is zero is known as a zero vector. The direction of zero vector is not defined.